

Na_2O and K_2O are components to adjust the coefficient of thermal expansion and the viscosity. However, if the contents are more than 10 %, the viscosity is excessively low so that the formation becomes difficult and the electrical resistivity is degraded. If the contents are less than 5 %, the coefficient of thermal expansion is excessively low and will not match the coefficient of expansion of the funnel glass. Preferably, the content of each of Na_2O and K_2O is within the range of 6-9 %.

ZrO_2 is a component to adjust the coefficient of thermal expansion and the viscosity and to improve the X-ray absorptivity. If the content is greater than 3 %, wadsite ($\text{K}_2\text{O} \cdot \text{ZrO}_2 \cdot 3\text{SiO}_2$) is deposited and the formation becomes difficult. Preferably, the content of ZrO_2 is within the range of 0.1-2.5 %.

TiO_2 is a component to suppress UV solarization of the glass. If the content is greater than 3 %, the effect can not remarkably be improved and the material cost becomes high. Preferably, the content of TiO_2 is within the range of 0.1-2 %.

CeO_2 is a component to suppress X-ray browning of the glass. If the content is greater than 3 %, the glass will be colored and the sufficient optical transmittance can not be obtained. Preferably, the content of CeO_2 is within the range of 0.1-2 %.

Sb_2O_3 can be used as a fining agent. However, if the content is greater than 2 %, the effect can not remarkably be improved and the material cost becomes high. Preferably, the content of Sb_2O_3 is 1 % or less.

P_2O_5 can be added to suppress the tendency of devitrification. However, if the content is greater than 2 %, separation of a liquid phase occurs and, inversely, devitrification will easily be caused. Preferably, the content of P_2O_5 is 1 % or less.

In order to suppress the deposition of barium disilicate and strontium silicate and to lower the liquidus temperature, the ratio of $\text{SrO}/(\text{SrO}+\text{BaO})$

Table 1

	Present Invention						Comparative Example	
	1	2	3	4	5	6	7	8
Composition (mass %)								
SiO ₂	61.6	62.4	61.3	60.6	61.8	60.3	61.9	59.5
Al ₂ O ₃	2.0	0.5	0.5	-	2.0	1.5	1.0	1.5
MgO	-	0.5	1.5	-	-	0.5	-	0.5
CaO	-	0.5	-	2.0	-	0.5	1.0	-
SrO	9.6	9.3	9.5	9.3	9.3	9.1	9.0	8.9
BaO	8.6	8.9	8.5	8.8	8.7	8.9	8.3	9.7
ZnO	0.5	1.0	0.2	2.0	0.5	-	2.0	0.1
Na ₂ O	7.6	8.0	8.5	7.0	7.6	6.5	7.5	7.1
K ₂ O	7.7	7.0	6.5	8.0	7.7	8.5	7.5	8.4
ZrO ₂	1.5	1.0	2.0	0.1	1.5	2.5	0.1	2.1
TiO ₂	0.4	0.2	0.1	0.3	0.4	1.1	0.3	0.5
CeO ₂	0.3	0.2	0.1	1.1	0.3	0.1	0.3	0.5
Sb ₂ O ₃	0.2	0.5	0.3	0.8	0.2	0.5	0.3	0.7
P ₂ O ₅	-	-	1.0	-	-	-	-	0.5
SrO/(SrO+BaO)	0.53	0.51	0.53	0.51	0.52	0.51	0.54	0.40
Coefficient of X-ray Absorption (0.6 Å, cm ⁻¹)	29.4	28.8	29.3	29.4	28.9	30.3	28.8	30.1
Liquidus Temperature (°C)	857	855	845	855	850	852	885	880

Each sample given in Table 1 was prepared in the following manner.

First, a material batch prepared to have a glass composition as defined in Table 1 was put into a platinum crucible and melted at about 1500 °C for 4 hours. In order to obtain a uniform or homogeneous glass, degassing was performed by stirring using a platinum stirring bar for three minutes in the middle of the melting process. Thereafter, the molten glass was formed into a predetermined shape and then gradually cooled.